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PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(19) 

(54) SLEEVE FOR A PINCH VALVE

(71) We, LAWJACK EQUIPMENT LIMITED, a Canadian Corporation, of 1975 Bois Franc Road, Montreal 382, Quebec, Canada, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to sleeves for pinch valves. Pinch valves have a resilient sleeve having a longitudinal bore defining a fluid flow path. The valve is closed by deforming opposite side walls of the bore into contact substantially to close the fluid flow path. The deformation may be caused by applying fluid pressure to the exterior wall of the sleeve or by squeezing the sleeve between upper and lower anvils by mechanical action.

The ends of the sleeve are normally held in spaced-apart positions, for example, by having integral flanges on the sleeve which are bolted to flanges on the ends of pipe lines. When the valve is closed the sleeve must accommodate the increased length of the body of the sleeve between the flanges caused by curvature of the sleeve. This causes strain in fabric reinforcing layers of the sleeve and leads to a short working life of the sleeve.

When pinch valves are used in a partly open condition in order to reduce or throttle the flow of fluid through the line to which they are connected, the sleeve tends to take the shape of a Venturi. The result is that a vacuum develops on the downstream side of the pinch. This vacuum is unstable and the internal pressure variations induce a flexing in the valve sleeve, which can cause early destruction to the valve sleeve, and in addition the fluttering produced in the sleeve by the Venturi effect can lead to severe vibration in the entire piping system. The existence of this phenomen has made it necessary to put severe limits on the throttling range in which pinch valves can be safely employed.

The basic solution to the problem of fluttering of valve sleeves under partly closed or throttling conditions, is to produce a sleeve which is sufficiently stiff so that it will not tend to collapse under the vacuum effect, and will thus maintain a stable shape.

According to the present invention there is provided a sleeve for a pinch valve comprising a tubular body member having an elastomeric inner wall defining a smooth flow path of substantially constant cross-section, and circumferential fabric reinforcing layers surrounding the inner wall and extending over the whole length of the body member between its ends, the middle portion of the body member being adapted to be deformed inwardly in order substantially to close the said flow path, and the body member having two circumferential regions respectively between its ends and the said middle portion in which the outer diameter is increased in order to stiffen the said regions of the sleeve and thereby enable them to resist inward deformation.

The end portions of the said circumferential fabric layers may be folded to form end flanges around the said inner wall. The flanges may be covered by a layer of elastomeric material and each flange may have an inner metal core.

The circumferential regions of increased outer diameter may be built up of layers of fabric and each end of each region may be tapered down to the diameter of the adjacent part of the body member. The outer surface of the sleeve may be covered by a layer of elastomeric material.

By the provision of two separate regions of increased diameter, respectively located adjacent the end portions of the pinch sleeve, extra stiffness is afforded to the sleeve on the downstream side of the pinch, irrespective of the direction of flow through the valve.

The invention will be described, by way of example, with reference to a preferred embodiment illustrated in the accompanying drawings, in which:—

Figure 1 is a longitudinal view, partly in section of a pinch valve sleeve according to the present invention;

Figure 2 is a transverse section taken on the line 2—2 of Figure 1;

Figure 3 is a partial longitudinal section taken from Figure 1 but showing a modified form of the reinforcements.

In the embodiment of the invention here shown for illustrative purposes the sleeve 1 is shown having a body member 2 and end flanges 3 and 4.

Means, now shown, are provided in the pinch valve assembly for applying pressure to the middle portion of the body member. This means may include a jacket surrounding the sleeve. into which pressurized fluid may be introduced for the purpose of compressing the sleeve to reduce the flow of fluid therethrough. Alternatively, the sleeve may be compressed by anvil means shown diagrammatically at 5 and 6 in Figure 1.

The body member 2 is cylindrical and has an inner wall 7 of non-corrosive elastomeric material to provide a smooth flow path of substantially constant cross-section through the body member.

The body member 2 is reinforced by a plurality of layers 8 of fabric which are wrapped circumferentially about the inner wall 7. In addition the body member 2 is circumferentially reinforced with additional material to increase its outer diameter at two regions A and B, one region A of reinforcement being located adjacent but spaced from the end flange 3, while the other region B or reinforcement is located adjacent but spaced from the end flange 4.

Each end of each of the circumferentially reinforced regions A and B is tapered down to the diameter of the adjacent part of the body member. The increased outer diameter of the regions A and B, and the tapers consist of layers 9 of fabric of successively decreasing width which are preferably placed between inner and outer layers 8*a* and 8*b* of the layers of fabric 8. in the manner shown in Figure 2

The outer surface of the body member 2 is covered by a layer of an elastomeric material 10 which entends longitudinally over the middle portion of the sleeve and over the enlarged and reinforced regions A and B and, if desired, may extend as far as the end flanges 3 and 4.

The end portions of the layers 8 of the reinforcing fabric may be wrapped about metal end rings 12 and sealed by a layer of elastomeric material to form the end flanges 3 and 4. Alternatively the end portions of the layers 8 of the reinforcing fabric may be formed into a flange shape without metal end rings.

In the modification shown in Fig. 3 of the drawings an annular layer 11 of an elastomeric material is shown wrapped about the outer surface of the inner wall 7 to form the base of the enlarged and reinforced regions A and B.

In using the sleeve, and upon closure of the valve, whether by the application of external pressurized fluid or by means of anvils 5 and 6, pressure is applied to the middle portion of the sleeve between the enlarged and reinforced regions A and B to bring the opposed walls of the flow path together

This application of pressure and deformation causes the opposed walls of the sleeve to curve and to have increased length. By providing increased fabric length, such as by the sections of layers 8*a* and 8*b* incorporated in the enlarged and reinforced regions A and B, the fabric layers 8 in that section of the sleeve between the regions A and B do not have to stretch appreciably to accommodate the increased length of the sleeve. Rather, as the inner wall 7 stretches, the portions of the fabric layers 8*a* and 8*b* having a radial directional component in the regions A and B provide the required increased fabric length. Thus, there is less strain on the fabric layers as a whole, leading to longer life of the sleeve.

On opening of the valve the additional fabric material within the regions A and B will tend to return to their original position, assisted by the inner annular ring 11 of elastomeric material, and the outer surface of elastomeric material 10.

The reinforced and enlarged regions A and B effectively reinforce the sleeve in the areas between the end flanges 3 and 4 and the middle section of the sleeve where force is applied to close the valve, yet have sufficient elasticity built into them to ensure that the sleeve will, throughout its whole length, return to its normal configuration on the release of the closing pressure.

The enlarged and reinforced regions A and B sufficiently stiffen the sleeve to prevent fluttering of the sleeve under partly closed or throttling conditions so as to prevent collapse of the sleeve under the vacuum effect. Such a sleeve will thus maintain a stable shape under all operating conditions.

This built-in strength and elasticity will ensure that the valve can be operated to open and close over a longer working life than has been possible in the past.

WHAT WE CLAIM IS:—

1. A sleeve for a pinch valve comprising a tubular body member having an elastomeric inner wall defining a smooth flow path of substantially constant cross-section, and circumferential fabric reinforcing layers surrounding the inner wall and extending over the whole length of the body member between its ends, the middle portion of the body member being adapted to be deformed inwardly in order substantially to close the

said flow path, and the body member having two circumferential regions respectively between its ends and the said middle portion in which the outer diameter is increased in order to stiffen the said regions of the sleeve and thereby enable them to resist inward deformation.

2. A pinch valve sleeve according to claim 1 in which the end portions of the said circumferential fabric layers are folded to form end flanges around the said inner wall.

3. A pinch valve sleeve according to claim 2 in which the said end flanges are covered by a layer of elastomeric material.

4. A pinch valve sleeve according to claim 2 or 3 in which the said end flanges have an inner metal core.

5. A pinch valve sleeve according to any preceding claim in which each end of each region of increased outer diameter is tapered down to the diameter of the adjacent part of the body member.

6. A pinch valve sleeve according to claim 5 in which the said regions of increased diameter are formed by layers of fabric of successively decreasing width interposed between layers of the fabric reinforcement.

7. A pinch valve sleeve according to claim 5 in which the said regions of increased diameter are each formed by a layer of elastomeric material wrapped around the said elastomeric inner wall and layers of fabric of successively decreasing width interposed between layers of the fabric reinforcement.

8. A pinch valve sleeve according to claim 1 in which the said fabric reinforcing layers have a greater length than the distance between the ends of the said inner wall.

9. A pinch valve sleeve according to claim 7 in which, when the valve is closed, some of the layers of reinforcing fabric adjacent the said inner wall are deformed radially to increase their length longitudinally of the sleeve by the said layer of elastomeric material, and the remaining outer layers of fabric of successively decreasing width are displaced radially by the layers of reinforcing fabric.

10. A pinch valve sleeve according to any preceding claim in which the outer surface of the sleeve is covered by a layer of elastomeric material.

11. A pinch valve sleeve substantially as described and shown in the accompanying drawings.

12. A pinch valve containing a pinch valve sleeve as claimed in any preceding claim.

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1321199 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

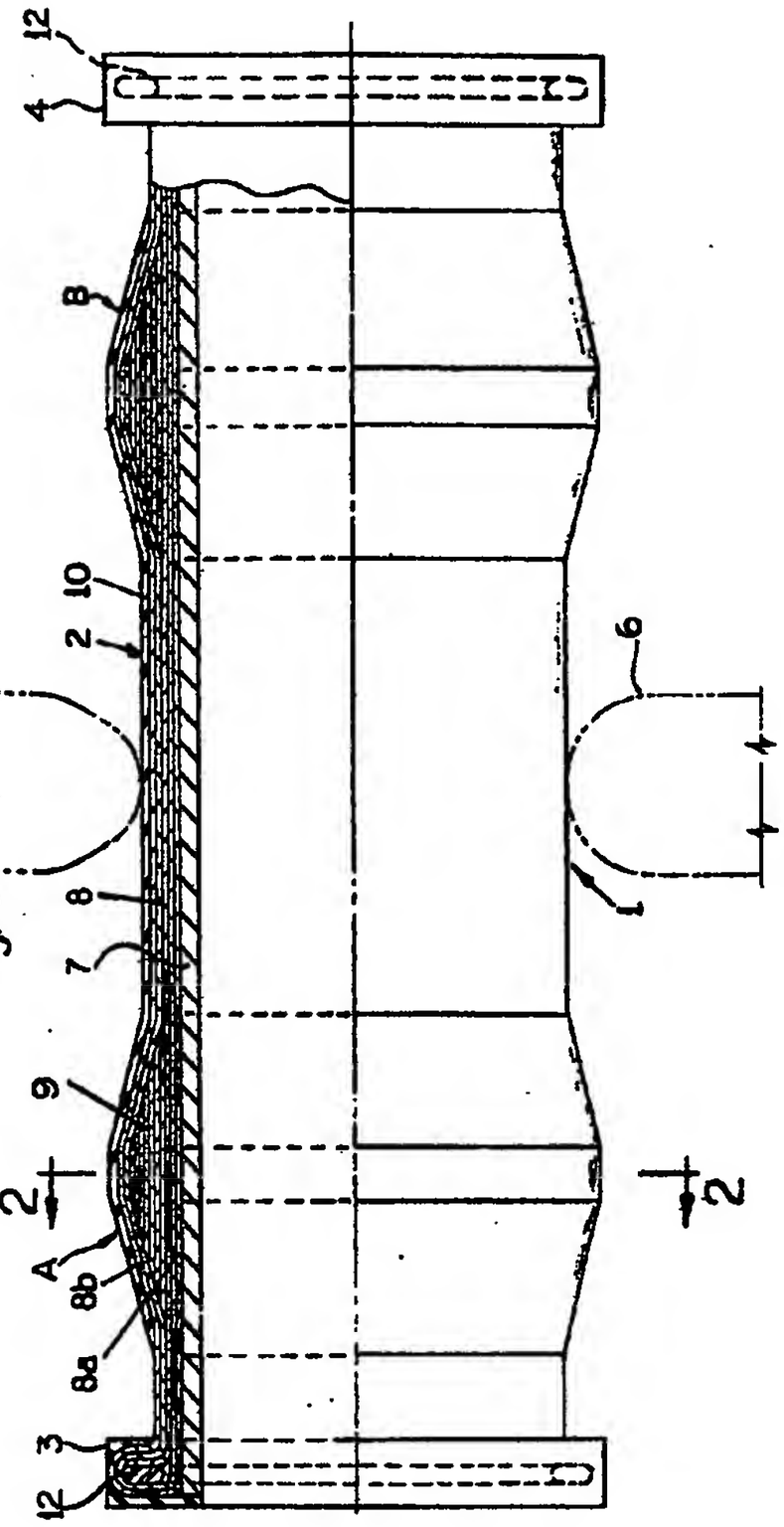

FIG. 1

1321199 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

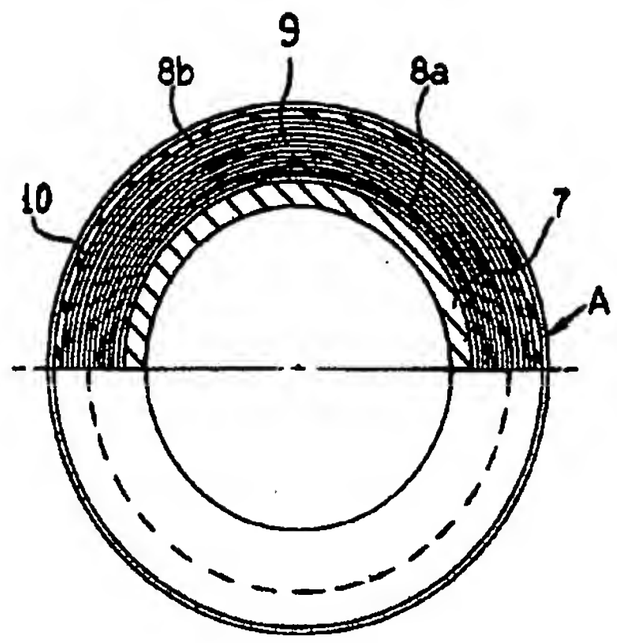

FIG. 2

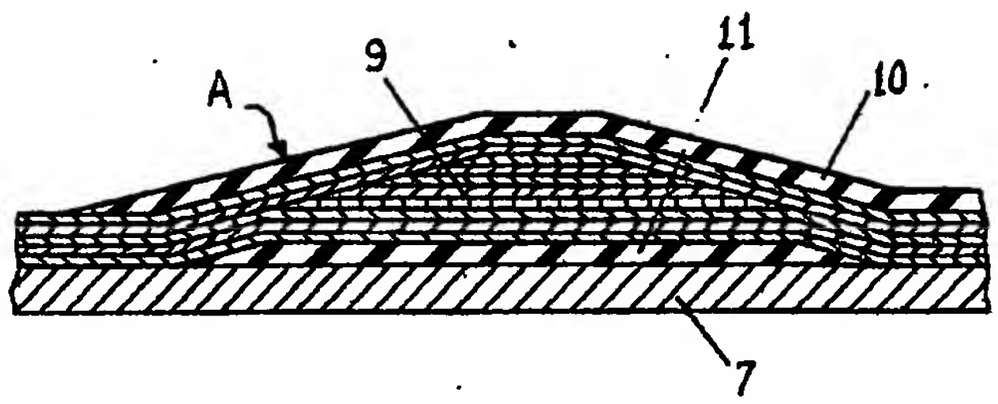

FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/031702

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16K7/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F16K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 259 985 A (BERGMANN WARREN C) 7 April 1981 (1981-04-07) column 2, line 4 - column 4, line 53; figures 1-4	1,2
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[X] Further documents are listed in the continuation of box C.

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° Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
8 December 2004	17/12/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Heneghan, M

INTERNATIONAL SEARCH REPORT

Inter ial Application No
PCT/US2004/031702

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/09381

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16K7/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F16K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

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X	US 5 379 790 A (BRUCE MARK L ET AL) 10 January 1995 (1995-01-10) column 3, line 59 -column 4, line 31; figures 5,6	1,4,6-12
X	US 6 036 166 A (OLSON DAVID L) 14 March 2000 (2000-03-14) column 1, line 51 -column 4, line 19; figures 1-6	1-4,12
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Date of the actual completion of the international search	Date of mailing of the international search report
21 July 2003	28/07/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Lanel, F-B

INTERNATIONAL SEARCH REPORT

International Application No
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